

7.) $f(x,y) = x e^{axy}$

$$f_x = e^{axy} + x \cdot ay e^{axy}$$

$$f_y = ax^2 e^{axy}$$

$$\nabla f = e^{axy} \langle 1 + axy, ax^2 \rangle$$

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8.) $f(x,y,z) = 3\sqrt{x^2+y^2+z^2}$

$$f_x = \frac{3}{2}(x^2+y^2+z^2)^{\frac{1}{2}} \cdot 2x = \frac{3x}{\sqrt{x^2+y^2+z^2}}$$

$$f_y = \frac{3}{2}(x^2+y^2+z^2)^{\frac{1}{2}} \cdot 2y = \frac{3y}{\sqrt{x^2+y^2+z^2}}$$

$$f_z = \frac{3}{2}(x^2+y^2+z^2)^{\frac{1}{2}} \cdot 2z = \frac{3z}{\sqrt{x^2+y^2+z^2}}$$

$$\frac{3}{\sqrt{x^2+y^2+z^2}} \langle x, y, z \rangle$$

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9.) $f(x,y) = x^2 - 9y$

$$f_x = 2x$$

$$f_y = -9$$

$$\nabla f(x,y) = \langle 2x, -9 \rangle$$

10.) $f(x,y) = 9\sqrt{x^2+y^2}$

$$f_x = 9 \cdot \frac{1}{2}(x^2+y^2)^{-\frac{1}{2}} \cdot 2x$$

$$f_y = 9 \cdot \frac{1}{2}(x^2+y^2)^{-\frac{1}{2}} \cdot 2y$$

$$f_x = \frac{9x}{\sqrt{x^2+y^2}}$$

$$f_y = \frac{9y}{\sqrt{x^2+y^2}}$$

$$\nabla f(x,y) = \frac{9}{\sqrt{x^2+y^2}} \langle x, y \rangle$$

11.) $v(x,y) = \langle x^2, x+y^2 \rangle$ $(x,y) = (1,4)$ at $t=5$
 $(x,y) = ?$ $t = 5.01$

$$[v(x)]_{(1,4)} = x^2 \hat{i} + (x+y^2) \hat{j} \Big|_{(1,4)} \quad \langle 1, 17 \rangle$$

$$\uparrow + (17) \hat{j}$$

$$t \langle \hat{i} + 17 \hat{j} \rangle$$

$$0.01 \langle \hat{i} + 17 \hat{j} \rangle = \langle 0.01 \hat{i} + 0.17 \hat{j} \rangle + \langle 1 \hat{i} + 17 \hat{j} \rangle$$

$$(1.01, 17.17)$$